MOTOROLA
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Canopy™ Cluster Management Module 2 (CMM2)

User Manual

CANOPY™
Motorola Wireless Broadband Platform

NOTICES

Important Note on Modifications
Intentional or unintentional changes or modifications to the equipment must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty.

U.S. Federal Communication Commision (FCC) and Industry Canada (IC) Notification
This device complies with part 15 of the U. S. FCC Rules and Regulations and with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. In Canada, users should be cautioned to take note that high power radars are allocated as primary users (meaning they have priority) of 5250 – 5350 MHz and 5650 – 5850 MHz and these radars could cause interference and/or damage to license-exempt local area networks (LELAN).

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the U.S. FCC Rules and with RSS-210 of Industry Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

FCC IDs and Industry Canada Certification Numbers are listed in the following table:

Module Types	Frequency Band Range	Maximum Transmitter Power	Reflector	FCC ID	Industry Canada Cert Number
SM AP BH	ISM 2400-2483.5 MHz	340 mW	Allowed on SM and BH	ABZ89FC5808	109W-2400
SM AP BH	U-NII 5250-5350 MHz	200 mW	Not Allowed	ABZ89FC3789	109W-5200
SM BH	U-NII 5250-5350 MHz	3.2 mW	Recommended	ABZ89FC5807	109W-5210
SM AP BH	U-NII 5725-5825 MHz	200 mW	Allowed on SM and BH	ABZ89FC4816	109W-5700
SM AP BH	ISM 5725-5850 MHz	200 mW	Allowed on SM and BH	ABZ89FC5804	109W-5700

The term "IC:" before the radio certification number only signifies that Industry Canada technical specifications were met.

European Community Notification
Notification of Intended Purpose of Product Uses
This product is a two-way radio transceiver suitable for use in Broadband RLAN systems. It uses operating frequencies which are not harmonized through the EC. All licenses must be obtained before using the product in any EC country.

Declaration of conformity:
Motorola declares the GHz radio types listed below comply with the essential requirements and other relevant provisions of Directive1999/5/EC.

Relevant Specification
EN 301 893 or similar - radio spectrum
EN301489-17 - EMC
EN60950 – safety

Product Details for Products Tested for Compliance with Relevant EC Directives

Module Type	Frequency Band Range	Maximum Transmitter Power	Effective Isotropic Radiated Power (EIRP)	Modulation Type	Operating Channels	Non-overlapping Channel Spacing
Access Point	5.725 to 5.825 GHz	200 mW RMS	1 Watt EIRP	High Index 2-level FSK	5745 to 5805 MHz in 5 MHz increments	20 MHz
Subscriber Module	5.725 to 5.825 GHz	200 mW RMS	1 Watt EIRP	High Index 2-level FSK	5745 to 5805 MHz in 5 MHz increments	20 MHz
Subscriber Module with Reflector	5.725 to 5.825 GHz	200 mW RMS	63 Watts EIRP	High Index 2-level FSK	5745 to 5805 MHz in 5 MHz increments	20 MHz
Backhaul	5.725 to 5.825 GHz	200 mW RMS	1 Watt EIRP	High Index 2-level or 4-level FSK	5745 to 5805 MHz in 5 MHz increments	20 MHz
Backhaul with Reflector	5.725 to 5.825 GHz	200 mW RMS	63 Watts EIRP	High Index 2-level or 4-level FSK	5745 to 5805 MHz in 5 MHz increments	20 MHz

Canopy can be configured to operate at a range of frequencies, but at this time, only channels from 5745 MHz through 5805 MHz of the 5.7 GHz product have been tested for compliance with relevant EC directives. Before configuring equipment to operate outside this range, please check with your regulator.

Exposure Note
A Canopy module must be installed to provide a separation distance of at least 20 cm (7.9 in) from all persons. When adding the Canopy reflector dish, the reflector dish must be installed to provide a separation distance of at least 1.5m (59.1 in) from all persons. When so installed, the module's RF field is within Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website http://www.hc-sc.gc.ca/rpb.

In both configurations the maximum RMS power does not exceed 340mW.

The applicable power density exposure limit is 10 Watt/m^2, according to the FCC OET Bulletin 65, the ICNIRP guidelines, and the Health Canada Safety Code 6. The corresponding compliance distances referenced above have been determined by assuming worst-case scenarios. The peak power density (*S*) in the far-field of a radio-frequency source with rms transmit power *P* and antenna gain *G* at a distance *d* is

$$S = \frac{P \cdot G}{4\pi d^2}$$

In the case of the Canopy SM *without* reflector, the gain is 8 dBi (a factor of 6.3), so the peak power density equals the exposure limit at a distance of 13 cm for 2.4 GHz product and 10 cm for 5.2 and 5.7 GHz product. A power compliance margin of over 2 is artificially introduced by setting the distance to a consistent 20 cm across all modules, giving a power compliance margin of x2.4 for 2.4 GHz modules and x4 for 5.2 and 5.7 GHz modules.

In the case of the Canopy SM *with* reflector, the gain depends on frequency and ranges from 19 dBi (a factor of 80) for 2.4 GHz modules to 26 dBi (a factor of 400) for 5.2 GHz Extended Range and 5.7 GHz modules, so the peak power density equals the exposure limit at a distance of 10 to 80 cm. A power compliance margin is artificially introduced by defining a consistent compliance distance of 1.5 m across all modules with reflectors, giving a power compliance margin of x10 for 2.4 GHz modules, x220 for 5.2 GHz Extended Range modules, and x3.5 for 5.7 GHz modules. The compliance distance is greatly overestimated in this case because the far-field equation neglects the physical dimension of the antenna, which is modeled as a point-source.

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Motorola U.S. offers a warranty covering a period of one year from the date of purchase by the customer. If a product is found defective during the warranty period, Motorola will repair or replace the product with the same or a similar model, which may be a reconditioned unit, without charge for parts or labor.

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http://www.motorola.com/canopy

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1   WELCOME

Thank you for purchasing the Motorola Canopy™ CMM2 (Cluster Management Module 2).[1]
This technology is the latest innovation in high speed wireless networking. Canopy system features include

- network speeds of 10/100 BaseT.
- small compact design.
- no special requirements for PC setup.

1.1   FEEDBACK

We welcome your feedback on Canopy system documentation. This includes feedback on the structure, content, accuracy, or completeness of our documents, and any other comments you have. Please send your comments to technical-documentation@canopywireless.com.

1.2   TECHNICAL SUPPORT

To get information or assistance as soon as possible for problems that you encounter, use the following sequence of action:

1. Search this document, the user manuals that support other modules, and the software release notes of supported releases

    a. in the Table of Contents for the topic.

    b. in the Adobe Reader® search capability for keywords that apply.[2]

2. Visit the Canopy systems website at http://www.motorola.com/canopy.

3. Ask your Canopy products supplier to help.

4. Gather information such as

    - the IP addresses and MAC addresses of any affected Canopy modules.

    - the software releases that operate on these modules.

    - data from the Event Log page of the modules.

    - the configuration of software features on these modules.

5. Escalate the problem to Canopy systems Technical Support (or another Tier 3 technical support that has been designated for you) as follows. You may either

    - send e-mail to technical-support@canopywireless.com.

    - call 1 888 605 2552 during the hours of operation:
      Monday through Sunday
      7:00 a.m. to 11:00 p.m. EST

For warranty assistance, contact your reseller or distributor for the process.

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[1] Canopy is a trademark of Motorola, Inc.
[2] Reader is a registered trademark of Adobe Systems, Incorporated.

2   ABOUT THIS DOCUMENT

The following information describes the purpose of this document and the reasons for reissue.

2.1   INTENDED USE

This manual includes Canopy features through Software Release 4.1. The audience for this manual comprises system operators, network administrators, and equipment installers. The user of this manual should have experience in

- power feed cabling
- GPS signal reception and sync cabling
- network feed cabling
- Ethernet cabling

2.2   NEW IN THIS ISSUE

This document has been revised to include changes in technical content.

Issue 5 introduces the following changes:

- Coverage limited to the CMM2 (Access Point Module information is now provided in a separate document.)
- Rearrangement of topics to make the document easier to return to as a reference source.
- Editorial changes to reduce redundancy and clarify technical concepts.
- Revision of the warranty stated in the legal section above (effective for products purchased on or after October 1, 2003).
- Required materials for cabling the CMM2. See Required Materials on Page 20.
- Corrections for the roles of Pins 4 and 5 (to +V return) and Pins 7 and 8 (to +V) and inclusion of a Protective Earth label for ground. See Connector Wiring on Page 20.
- Reminders to observe local and national regulations.

2.3   ADDITIONAL FEATURE INFORMATION

Additional information about features that are introduced in new releases is available in Canopy Software Release Notes. These release notes are available at http://www.motorola.com/canopy.

3 SYSTEM OVERVIEW

The Canopy network uses the Canopy components that are defined in Table 1.

Table 1: Definitions of Canopy components

Component	Definition
AP (Access Point Module)	One module that distributes network or Internet services in a 60° sector to 200 subscribers or fewer.
AP cluster (Access Point cluster)	Two to six APs that together distribute network or Internet services to a community of 1,200 or fewer subscribers. Each AP covers a 60° sector. This cluster covers as much as 360°.
SM (Subscriber Module)	A CPE (customer premises equipment) device that extends network or Internet services by communication with an AP or an AP cluster.
CMM (Cluster Management Module)	A module that provides power, GPS timing, and networking connections for an AP cluster. If this CMM is connected to a BH (Backhaul Module), then this CMM is the central point of connectivity for the entire site.
BH (Backhaul Module)	A module that provides point-to-point connectivity as either a standalone link or a link to an AP Cluster through a selected AP.

3.1 MODULE-TO-MODULE COMMUNICATIONS

Each SM communicates with an AP in an assigned time slot that the AP controls. The AP coordinates the needs of SMs for data in both the downlink and the uplink to provide seamless communication across the entire network. The BH communicates with another BH, a collocated connection to the network, and a collocated AP.

The AP uses a point-to-multipoint protocol to communicate with each registered SM. The BH timing master uses a point-to-point protocol to communicate with a BH timing slave.

For more information about the AP, see **Canopy** Access Point Module (AP) User Manual. For more information about the SM, see **Canopy** Subscriber Module (SM) User Manual. For more information on the BH, see **Canopy** Backhaul Module (BH) User Manual.

3.2 SYNCHRONIZATION

The CMM is a critical element in the operation of the Canopy system. At one AP cluster site or throughout an entire wireless system, the CMM provides a GPS timing pulse to each module, synchronizing the network transmission cycles.

3.2.1 Unsynchronized Modules

Without this pulse, an AP is unsynchronized, and a BH timing master cannot synchronize a BH timing slave. An unsynchronized module may transmit during a receive cycle of other modules. This can cause one or more modules to receive an undesired signal that is strong enough to make the module insensitive to the desired signal (become desensed).

3.2.2 Passing sync

In releases earlier than Release 4.0, network sync can be delivered in only one over the air link in any of the following network designs:

- Design 1

    1. A CMM provides sync in Ethernet protocol to a collocated AP.

    2. This AP sends the sync in multipoint protocol over the air to SMs.

- Design 2

    1. A CMM provides sync in Ethernet protocol to a collocated BH timing master.

    2. This BH timing master sends the sync in point-to-point protocol over the air to a BH timing slave.

In Release 4.0 and later releases, network sync can be either delivered as described above or extended by one additional link in any of the following network designs:

> *NOTE:* In each of these following designs, Link 2 *is not* on the same frequency band as Link 4. (For example, Link 2 may be a 5.2-GHz link while Link 4 is a 5.7- or 2.4-GHz link.)

- Design 3

    1. A CMM provides sync in Ethernet protocol to a collocated AP.

    2. This AP sends the sync in multipoint protocol over the air to an SM.

    3. This SM delivers the sync in Ethernet protocol to a collocated AP.

    4. This AP passes the sync in multipoint protocol in the additional link over the air to SMs.

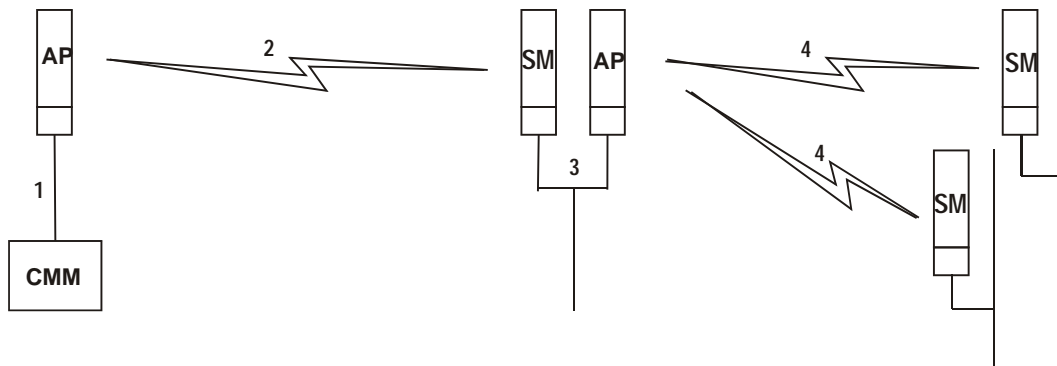This design in illustrated in Figure 1.

Figure 1: Additional link to extend network sync, Design 3

- Design 4

    1. A CMM provides sync in Ethernet protocol to a collocated AP.

    2. This AP sends the sync in multipoint protocol over the air to an SM.

    3. This SM delivers the sync in Ethernet protocol to a collocated BH timing master.

    4. This BH timing master passes the sync in point-to-point protocol in the additional link over the air to a BH timing slave.

This design is illustrated in Figure 2.
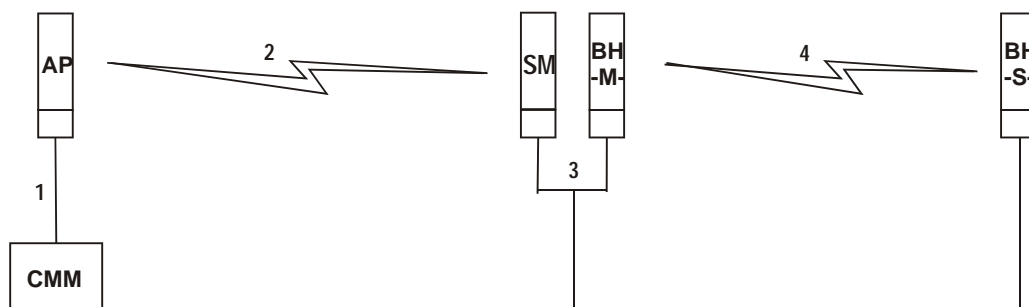

Figure 2: Additional link to extend network sync, Design 4

- Design 5

   1. A CMM provides sync in Ethernet protocol to a collocated BH timing master.

   2. This BH timing master sends the sync in point-to-point protocol over the air to a BH timing slave.

   3. This BH timing slave delivers the sync in Ethernet protocol to a collocated AP.

   4. This AP passes the sync in multipoint protocol in the additional link over the air to SMs.
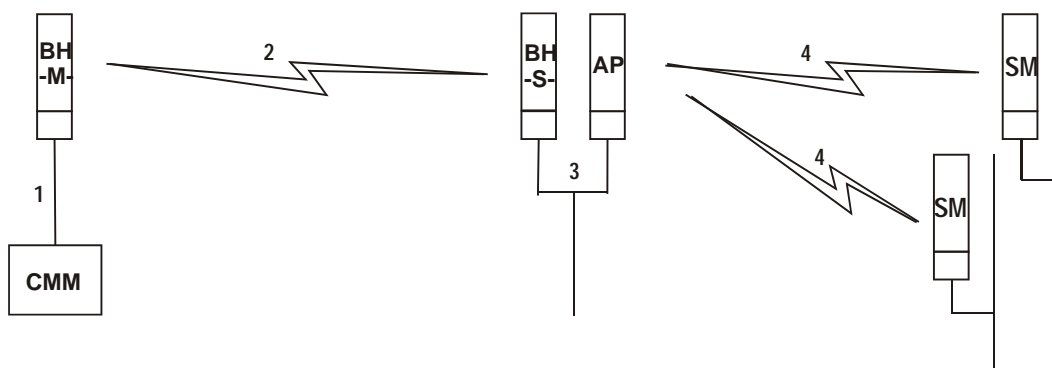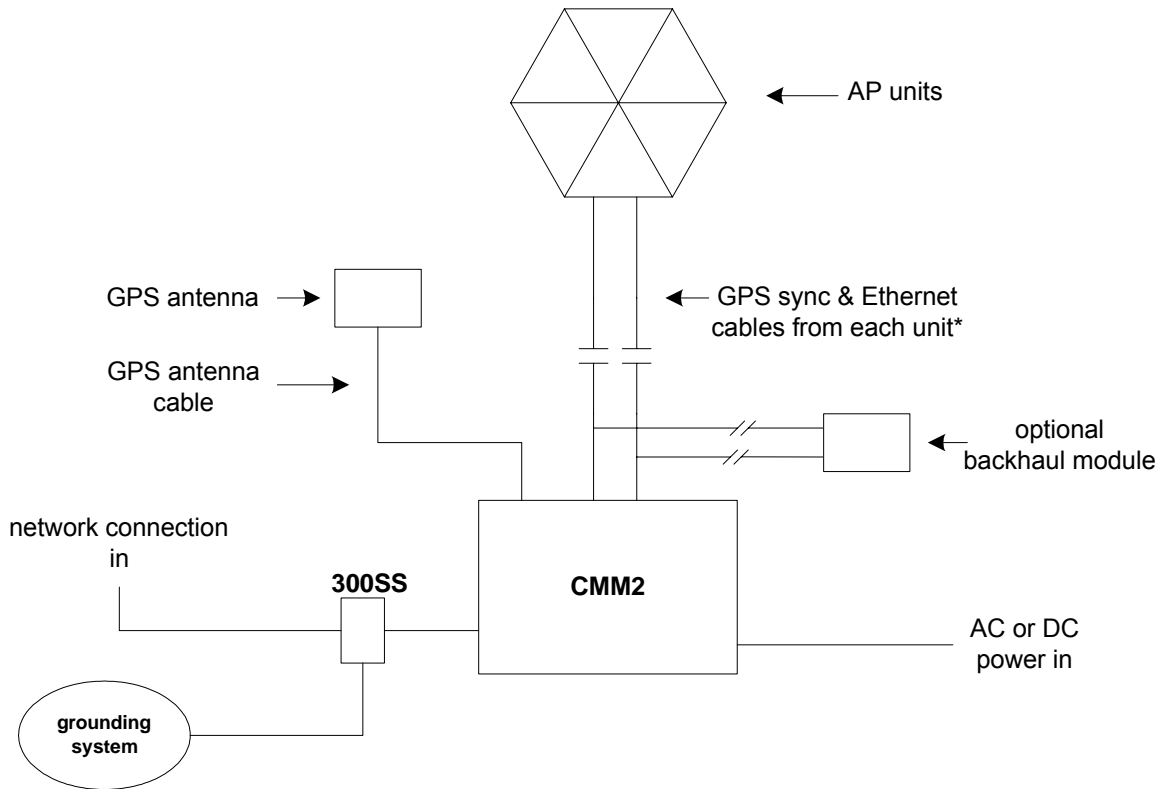
This design is illustrated in Figure 3.

Figure 3: Additional link to extend network sync, Design 5

3.3   WIRING

The wiring scheme of the Canopy system is displayed in Figure 4.

* Two cables, Ethernet and GPS sync, connect *each* sector AP to the CMM2.

Figure 4: Canopy system wiring

3.3.1   Lightning Protection

The network plan must include lightning protection. The following precautions are strongly recommended:

- Install a lightning protection system for the site.

- Observe all local and national codes that apply to grounding for lightning protection.

- Use a Canopy Surge Suppressor to protect equipment from surges on the Ethernet cable that is connected to the Canopy System.

3.3.2   Electrical Requirements

The network plan must also conform to applicable country and local codes, such as the NEC (National Electrical Code) in the US. If uncertain of code requirements, the planner should engage the services of a licensed electrician.

4   SITE PLANNING

In a typical Canopy network, site selection for the CMM2 is based on

- the location of the GPS antenna.
- the locations of APs and BHs that will be connected to the CMM2.
- the access to 24-VDC power, if the CMM2 will not operate on AC power.

4.1   DISTANCE FROM OTHER COMPONENTS

The CMM2 requires separation of

- not longer than 328 feet (100 meters) of cable length from the furthest AP or BH.
- not less than 10 feet (3 meters) of space from the nearest AP or BH.
- not longer than 100 feet (30.5 meters) of cable length from the GPS antenna.

4.2   DISTANCE FROM 24-VDC POWER SUPPLY

In an application where the CMM2 will operate on 24-VDC power, the CMM2 requires separation of not longer than 400 feet (120 meters) of cable from the power supply.

4.3   ENVIRONMENT

The CMM2 may be mounted outdoors or indoors. As with all other Canopy network components, the integrity of the cables that connect to the CMM2 is critical to proper operation. The cables recommended in CANOPY SYSTEM ACCESSORIES on Page 27 conform to the CMM2 operational standards for both UV tolerance and ambient temperature range.

The ambient temperature range for CMM2 operation is −40°C to +55°C, or −40°F to +131°F.

5 CMM2 INSTALLATION

The following steps are required to install a Canopy CMM2:

- Unpacking the Canopy Products. See Page 15.

- Mounting the CMM2. See Page 16.

- Mounting the GPS antenna. See Page 17.

- Cabling the CMM2. See Page 18.
  NOTE: Procedures for cabling, configuring, and installing the AP are provided in *Canopy Access Point Module (AP) User Manual*.

- Verifying System Performance. See Page 26.

5.1 UNPACKING THE CANOPY PRODUCTS

Upon receipt, carefully inspect all shipping boxes for signs of damage. If you find damage, immediately notify the transportation company.

Unpack the equipment, making sure that all of the components ordered have arrived. Saving all the packing materials is recommended. These can be used to either return products or transport the equipment to and from installation sites.

5.1.1 AP and BH Component Layout

As shown in Figure 5, the base cover of the AP or BH snaps off when a lever on the back of the base cover is depressed. This exposes the Ethernet and Global Positioning System (GPS) sync connectors and diagnostic LEDs.
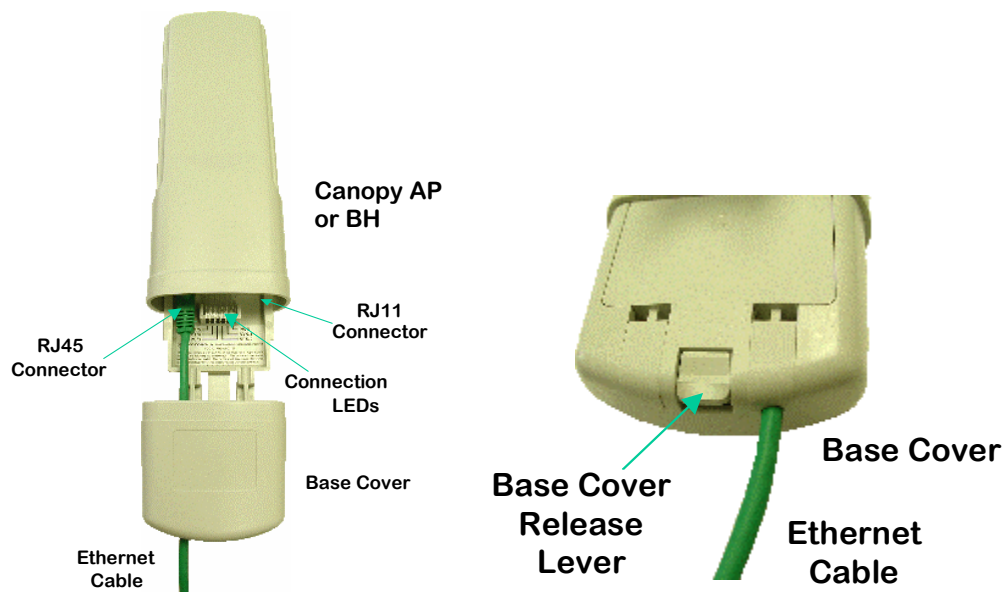

Figure 5: Canopy AP or BH base cover, attached and detached

5.1.2 CMM2 Component Layout

As shown in Figure 11 on Page 25, the CMM2 comprises four assemblies:

- Ethernet switch
- Power transformer
- Interconnect board
- GPS receiver.

Some CMM2s that were sold earlier had four openings on the bottom of the Cluster Management Module as shown in Figure 6. Currently available CMM2s have two *additional* Ethernet cable and GPS sync cable openings to allow use of thicker shielded cables.
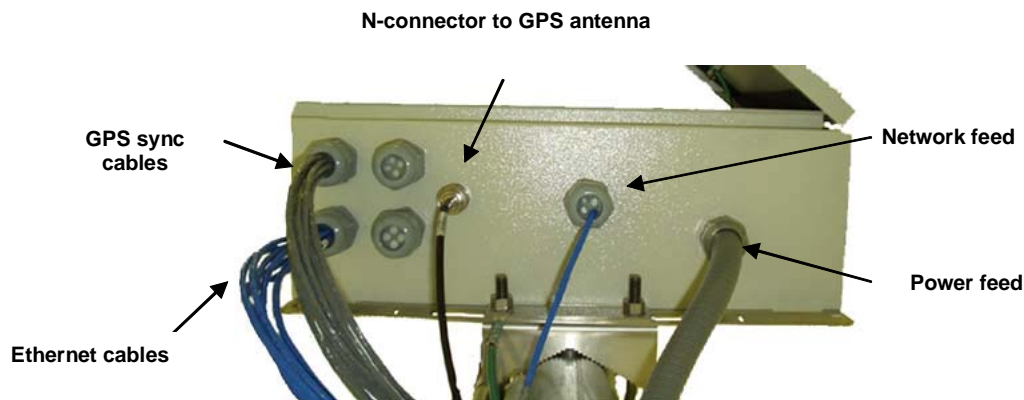

Figure 6: Canopy CMM2, bottom view

5.2 MOUNTING THE CMM2

The following information describes the recommended tools and procedures to mount the CMM2.

5.2.1 Recommended Tools

The following tools may be needed for mounting the CMM2:

- 3/8" nut driver
- 12" adjustable wrench
- 14-mm wrench for pole-mounting
- needle-nose pliers

5.2.2 CMM2 Mounting Procedure

Perform the following procedure to mount the CMM2:

1. Ensure that the mounting position

   - *is not* further than 328 feet (100 meters) from the furthest AP or BH that the CMM2 will serve.

   - *is not* closer than 10 feet (3 meters) to the nearest AP or BH.

   - *is not* further than 100 feet (30.5 meters) of cable from the intended mounting position of the GPS antenna. See Mounting the GPS antenna on Page 17.

2. Select a support structure to which the flanges of the CMM2 can be mounted.

3. If the support structure is a wall, use screws or bolts (neither is provided) to attach the flanges to the wall.

4. If the support structure is an irregular-shaped object, use adjustable stainless steel bands (provided) to attach the CMM2 to the object.

5. If the support structure is a pole that has an outside diameter of 3 to 8 cm, or 1.25 to 3 inches, use a toothed V-bracket (provided) to

   a. attach the V-bracket to the pole as shown in Figure 7.

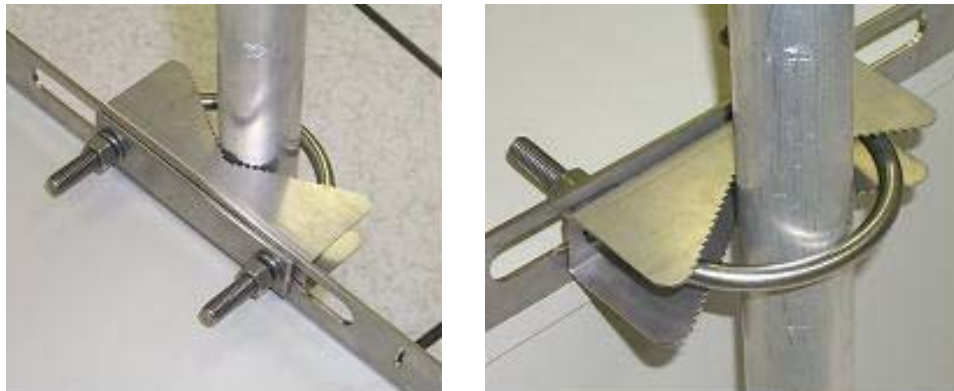   b. attach the CMM2 flanges to the V-bracket.

Figure 7: Detail of pole mounting

5.3   MOUNTING THE GPS ANTENNA

The following information describes the recommended tools and procedures to mount the GPS antenna.

5.3.1 Recommended Tools

The following tools may be needed for mounting the GPS antenna:

- 3/8" nut driver

- 12" adjustable wrench

- 7/16" wrench

- Needle-nose pliers

5.3.2   GPS Antenna Mounting Procedure

Perform the following procedure to mount the GPS antenna:

1. Ensure that the mounting position

    - has an unobstructed view of the sky, 20º above the horizon.

    - *is not* the highest item at the site. (This is important for lightning protection.)

    - *is not* further than 100 feet (30.5 meters) of cable from the CMM2.

2. Select a pole that has an outside diameter of 1.25 to 1.5 inches (3 to 4 cm) to which the flange of the GPS antenna can be mounted.

3. Place the U-bolts (provided) around the pole as shown in Figure 8.

Figure 8: Detail of GPS antenna mounting

4. Slide the GPS antenna flange onto U-bolts.
5. Slide the ring washers (provided) onto the U-bolts.
6. Slide the lock washers (provided) onto the U-bolts.
7. Use the nuts (provided) to fasten the flange to the U-bolts.

5.4   CABLING THE CMM2

The use of shielded cable for all Canopy system infrastructure associated with BHs, APs, and CMM2s is *strongly* recommended. The environment these modules operate in typically has significant unknown or varying RF energy. Operator experience consistently indicates that the additional cost of shielded cables is more than compensated by predictable operation and reduced costs for troubleshooting and support.

5.4.1 Standards for Wiring

The following information describes the wiring standards for installing a Canopy system.
All diagrams use the EIA/TIA-568B color standard.

Either RJ-45 straight-thru or RJ-45 crossover cable can be used to connect a network interface card (NIC), hub, router, or switch to a module. Canopy modules that are currently available can auto-sense whether the Ethernet cable in a connection is wired as straight-thru or crossover. Some modules that were sold earlier do not.

Table 2 identifies by MAC address whether a module auto-senses the Ethernet cable type.

Table 2: Module auto-sensing per MAC address

Module Type	MAC Address (ESN) of Non Auto-sensing Module	MAC Address (ESN) of Auto-sensing Module
2.4-GHz modules	(no ESNs)	(all ESNs)
5.2 Modules	≤ 0a003e0021c8	≥ 0a003e0021c9
5.7 Modules	≤ 0a003ef00f79	≥ 0a003ef00f79a

Where a non auto-sensing module is used

- use an RJ-45 straight-thru cable to connect to a network interface card (NIC).
- use an RJ-45 crossover cable to connect to a hub, switch, or router.

Where the Canopy AC wall adapter is used

- the +V is +11.5 VDC to +30 VDC, with a nominal value of +24 VDC.
- the maximum Ethernet cable run is 328 feet (100 meters).

5.4.2 Recommended Tools

The following tools may be needed for cabling the Canopy module:

- RJ-11 crimping tool
- N-male connector crimping tool
- RJ-45 crimping tool
- electrician scissors
- wire cutters
- wire stripper
- soldering iron
- solder
- cable testing device.

5.4.3 Required Materials

The following materials are required for cabling the GPS antenna:

- 100 feet (30.5 meters) of LMR200 coaxial cable

- 2 Times Microwave N-male connectors (Times Microwave P/N TC-200-NM) or equivalent connectors.

5.4.4 Connector Wiring

The following diagrams correlate pins to wire colors and illustrate crossovers where applicable.

RJ-45 Straight-thru Ethernet Cable

Pin 1 → white / orange   ← Pin 1
Pin 2 → orange   ← Pin 2
Pin 3 → white / green   ← Pin 3
Pin 4 → blue   ← Pin 4
Pin 5 → white / blue   ← Pin 5
Pin 6 → green   ← Pin 6
Pin 7 → white / brown   ← Pin 7
Pin 8 → brown   ← Pin 8

Pin	RJ-45 Straight-thru	Pin
TX+ 1		1 RX+
TX- 2		2 RX-
RX+ 3		3 TX-
+V return [4		4] +V return
5		5
RX- 6		6 TX-
+V [7		7] +V
8		8

Pins 7 and 8 are used to carry power to the Canopy modules.

RJ-45 Crossover Ethernet Cable

Pin 1 →	white / orange	← Pin 3
Pin 2 →	orange	← Pin 6
Pin 3 →	white / green	← Pin 1
Pin 4 →	blue	← Pin 4
Pin 5 →	white / blue	← Pin 5
Pin 6 →	green	← Pin 2
Pin 7 →	white / brown	← Pin 7
Pin 8 →	brown	← Pin 8

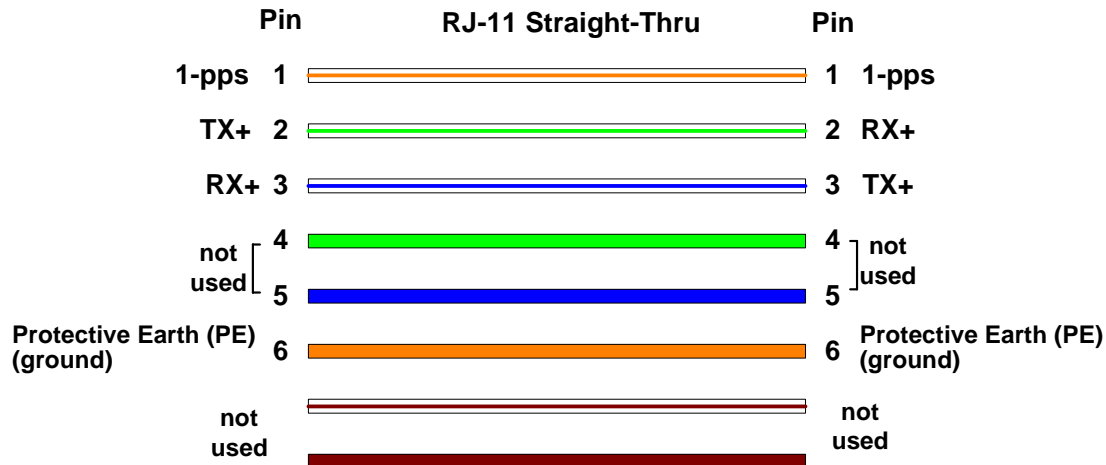|	**Pin**	**RJ-45 Crossover**	**Pin**	
TX+	**1**		**3**	**RX+**
TX-	**2**		**6**	**RX-**
RX+	**3**		**1**	**TX+**
+V return	**4**		**4**	**+V return**
	5		**5**	
RX-	**6**		**2**	**TX-**
+V	**7**		**7**	**+V**
	8		**8**	

Pins 7 and 8 are used to carry power to the Canopy modules.

RJ-11 Straight-thru GPS sync cable

An RJ-11 cable is commonly used to connect a device to a phone line. This cable resembles the RJ-45 Ethernet cable except for a thinner cord and smaller plug. The Canopy system uses an RJ-11 cable to connect the AP or BH to GPS synchronization. Presuming CAT 5 cable and 6-pin RJ-11 connectors, the following diagram shows the wiring of the cable for GPS sync.

Pin 1 → white / orange   ← Pin 1
Pin 2 → white / green   ← Pin 2
Pin 3 → white / blue   ← Pin 3
Pin 4 → green   ← Pin 4
Pin 5 → blue   ← Pin 5
Pin 6 → orange   ← Pin 6

NOTE: The fourth pair is not used.

Pin		RJ-11 Straight-Thru		Pin	
1-pps	1		1	1-pps	
TX+	2		2	RX+	
RX+	3		3	TX+	
not used	4		4	not used	
	5		5		
Protective Earth (PE) (ground)	6		6	Protective Earth (PE) (ground)	
not used				not used	

5.4.5 Configuration from the Factory

From the factory, the AP is configured to *not transmit* on any frequency. This configuration ensures that an operator does not accidentally turn on an unsynchronized AP. Site synchronization of APs is required for the following reasons:

- Canopy modules
  - transmit or receive, but not at the same time.
  - use TDD (Time Division Duplexing) to distribute signal access of the downlink and uplink frames.
- When one AP transmits while another receives signal, the transmitting module may interfere with or desense the receiving module. In this context, interference is self-interference (within the same Canopy network).

⚠ One AP in each AP cluster must be connected to the master port on the CMM2, and each module connected to a CMM2 must be configured to **Sync to Received Signal (Timing Port)**. If either is not done, then the GPS receiver sends no sync pulse to the remaining ports.

5.4.6 Cabling Procedure

Perform the following procedure to attach the CMM2 cables on both ends:

1. Remove the base cover from any AP or BH that is to be connected to this CMM2. See Figure 5 on Page 15.

2. Remove the GPS sync cable knockout from the base cover.

3. For any AP that is to be connected to this CMM2, set the AP **Sync Input** Configuration Page parameter to the **Sync to Received Signal (Timing Port)** selection.

4. Review the schematic drawing inside the CMM2.

⚠️ Failure to perform the following step can result in damage to equipment.

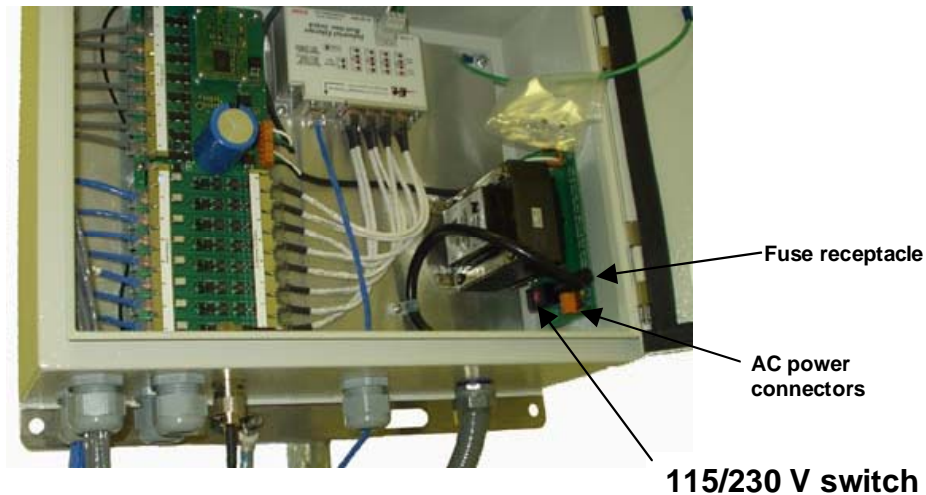5. Set the 115-/230-volt power switch in the CMM2 consistent with the power source. See Figure 9.

Figure 9: Location of 115-/230-volt switch

NOTE: The AC power connectors are labeled **N** for Neutral, **L** for Line, and **PE** for Protective Earth (PE) ⏚ or ground. The maximum thickness of wire to be used is 4 mm^2 or 12 AWG.

6. Route the Ethernet cables from the APs and or BHs to the CMM2.

   The strain relief plugs on the CMM2 have precut holes. Each hole of the strain relief is designed to hold two CAT 5 UTP cables or one shielded cable. The Ethernet cables have RJ-45 (standard Ethernet) connectors that mate to corresponding ports inside the CMM2.

   These ports are labeled **J3**. Eight J3 ports are available on the CMM2 to accommodate any combination of APs and BHs.

   NOTE: The logical connections in the CMM2 are displayed in Figure 10.
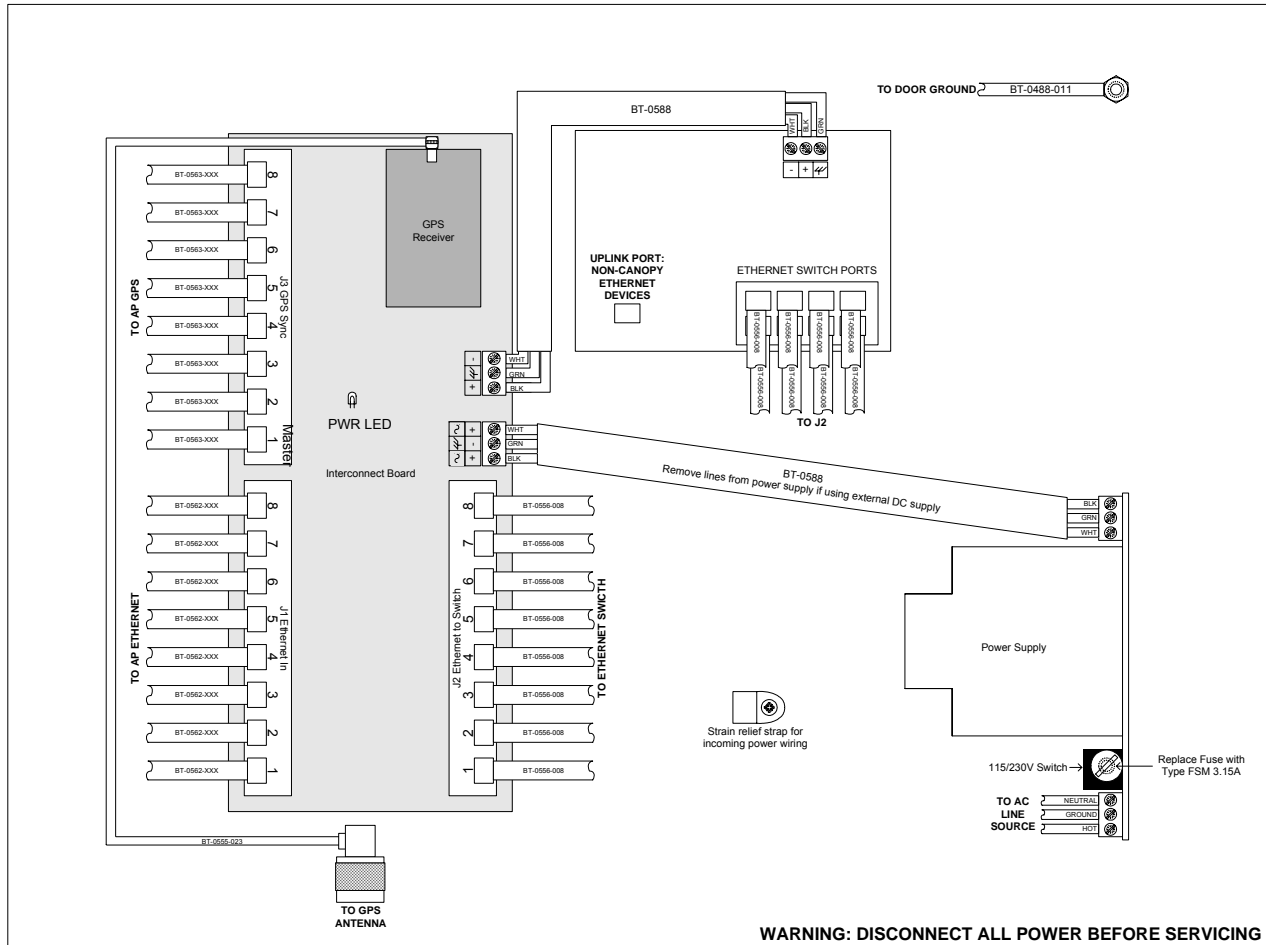

Figure 10: Layout of logical connections in CMM2

7. Connect the Ethernet cable from the first AP or BH to the **Port 1** in the J3 ports in the CMM2. This port is the *master* Ethernet port for the CMM2 and should be connected first in all cases. Figure 11 on Page 25 is a photograph of a properly wired CMM2.

Ethernet switch

Extra fuse

GPS
sync

Ethernet

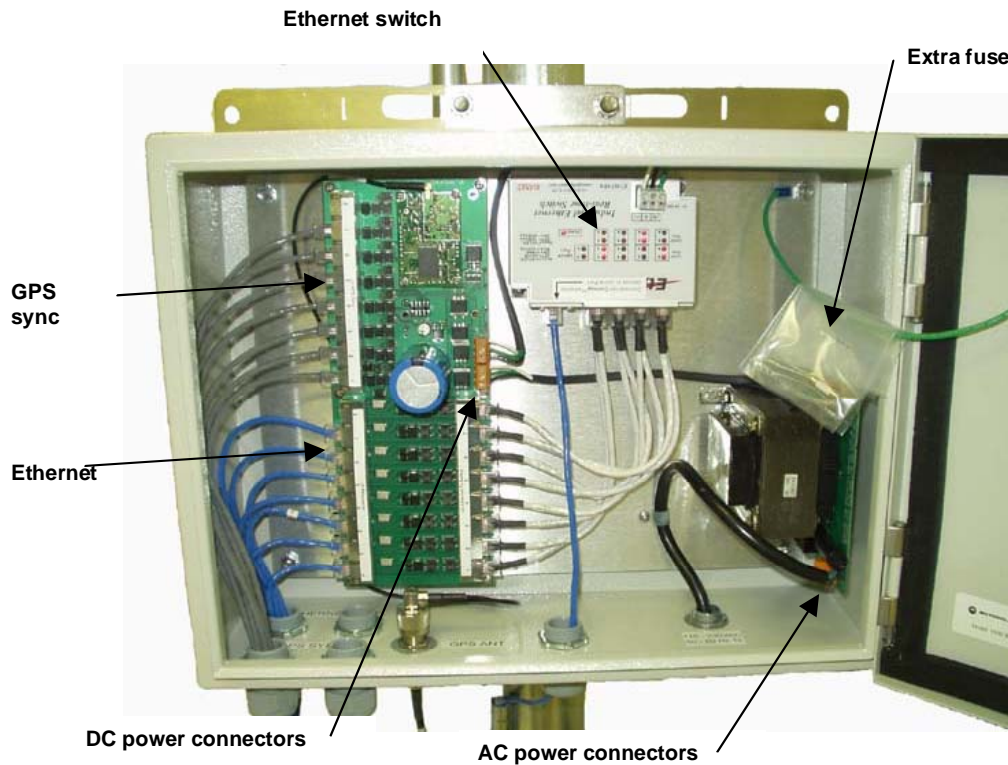DC power connectors

AC power connectors

Figure 11: Canopy CMM2, front view

8. Connect the remaining Ethernet cables to the remaining J3 ports.

9. Route the GPS sync (serial) cables from the APs to the CMM2.

   The GPS sync cables have 6-conductor RJ-11 connectors that mate to corresponding ports inside the CMM2.

   These ports are labeled **J1**. Eight J1 ports are available on the CMM2 to accommodate any combination of APs and BHs.

10. Connect the GPS sync cable from the first AP or BH to the **Port 1** in the J1 ports in the CMM2. See Figure 11 on Page 25.

    This port is the *master* GPS sync port for the CMM2 and should be connected first in all cases. This is necessary to initialize the GPS on the CMM2.

11. Connect the remaining GPS sync cables to the remaining J1 ports.

12. If this CMM2 requires network connection, perform the following steps:

    a. Route a network cable into the CMM2.

    b. Connect to the uplink port on the switch.

    c. Properly ground (connect to protective earth) the Ethernet cable. The Canopy Surge Suppressor provides proper grounding for this situation.

13. Connect GPS coaxial cable to the N-connector on the outside of the CMM2. See Figure 6 on Page 16.

14. Connect AC or DC power to the CMM2, consistent with Figure 10 on Page 24.

    When power is applied, the following indicators are lighted:

    - the power LED on the Ethernet switch

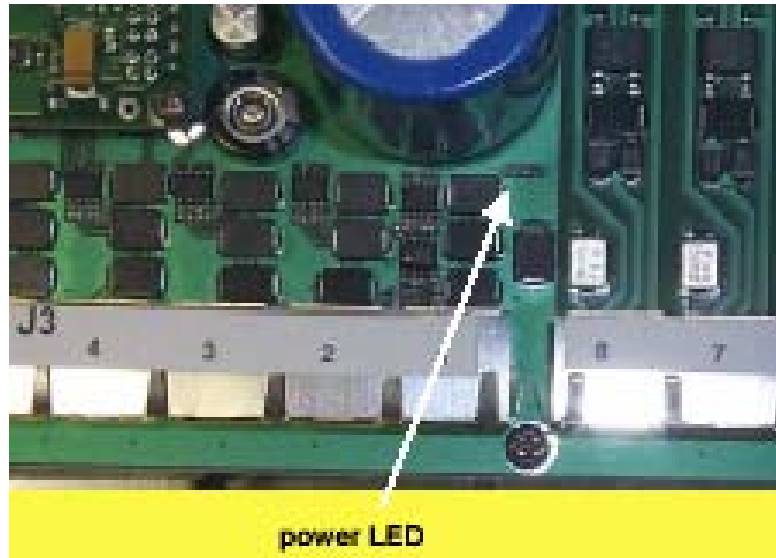   - the green LED on the circuit board, as shown in Figure 12.

Figure 12: Port indicator LED on Ethernet switch

15. Verify that each port indicator LED on the Ethernet switch is lit (each AP or BH is reliably connected to the Ethernet switch).

16. Replace the base cover on each AP or BH.

17. Close and lock the CMM2.

5.5   VERIFYING SYSTEM PERFORMANCE

To verify the performance of the Canopy system after the APs and or BHs have been installed, perform the following steps:

1. Access the web-based interface for each AP or BH by opening
   http://<ip-address>, where the *<ip-address>* is the address of the individual module.

2. In the menu on the left-hand side of the web page, click on **GPS Status**.

3. Verify that the AP or BH is seeing and tracking satellites. (To generate the timing pulse, the module must track at least 4 satellites.)

6   CANOPY SYSTEM ACCESSORIES

The following accessories are available to use with the Canopy system. To purchase accessories, contact an authorized Canopy system dealer unless otherwise noted.

- Universal mounting bracket

- Passive reflector dishes

- 102 − 132 VAC power supply with North American plug (Part Number ACPS110)

- 100 − 240 VAC power supply with North American, UK, and Euro plugs (Part Number ACPSSW-02)

- Cable assemblies for the Canopy system. These can be ordered from Best-Tronics Manufacturing, Inc. at http://www.best-tronics.com/motorola.

  NOTE: For the RF environment in which Canopy BH, AP, and CMM2 modules often operate, the use of shielded cable is *strongly* recommended for infrastructure cables that connect these modules.

7   CMM2 SPECIFICATIONS

Data in this section provide the physical, power, and cable specifications of the Canopy CMM2.

7.1   PHYSICAL SPECIFICATIONS

Specification	Canopy System Range
Maximum distance from CMM2 to AP or BH	328 feet (100 meters) of cable.
Minimum distance to any AP or BH	10 feet (3 meters)
Maximum distance from GPS antenna to CMM2	100 feet (30.5 meters) of cable.
Dimensions	17.00" H x 12.88" W x 6.50" D (43.18 cm H x 32.72 cm W x 16.51 cm D)
Weight	25.0 lb (11.3 kg)
Operation temperature range	−40° F to +131° F (−40° C to +55° C)
Overall	Meets CE IP44, according to EN60529:2000.

7.2   AC POWER SPECIFICATIONS

Specification	Canopy System Range
Input voltage and frequency	100 to 240 VAC, 0.7 to 0.35 A, settable to either 230 or 115 VAC nominal input. 50 Hz to 60 Hz. *Note:* If 230 VAC is applied to a unit that is set to 115 VAC, the unit may become damaged.
Input power	Nominal 66 W, maximum 92 W with 8 modules connected to the CMM2 at maximum specified cable length.

7.3   DC POWER (24V) OPTION

Specification	Canopy System Range
Input voltage	18 to 32 VDC, measured at the CMM2.
Input power	Nominal 60 W. Maximum 84 W with 8 modules connected to the CMM at maximum specified cable length.
Power supply	At least 9 A.
Inrush at start up	9 A
Maximum distance to power supply	If using a typical 24-V +/−5% power supply, 400 feet (120 meters) of cable.
Minimum wire gauge to power supply	12 AWG (4 mm^2)

7.4   DC POWER (12V) OPTION

Specification	Canopy System Range
Input voltage	11.5 to 32 VDC, measured at the CMM2.
Power supply	At least 8 A.
Maximum distance to power supply	If using a 12V power source (for example, an automobile battery in a test or emergency situation), 10 feet (3 meters) of cable.
Maximum distance to AP or BH served	If using a 12V power source, 20 feet (6 meters) of cable.
Minimum wire gauge to power supply	If using a 12V power source, 12 AWG (4 mm^2).

7.5   CABLE SPECIFICATIONS

Specification	Canopy System Range
Ethernet, GPS sync, and GPS coax cables	The use of cables that are rated for the operation temperature of the product and that conform to UV light protection specifications is mandatory. The use of shielded cables is strongly recommended. For information about the supplier of these cables, see CANOPY SYSTEM ACCESSORIES on Page 27.

8   HISTORY OF CHANGES IN THIS DOCUMENT

Issue 4 introduced the following changes:

- Information that supports Release 4.1 features
- Information that supports 2.4-GHz modules

Issue 3 introduced the following changes:

- Advanced Encryption Standard (AES) security product description
- 5.7-GHz ISM support of 6 channels (increased from 4 with 5.7-GHz U-NII)
- 5.7-GHz ISM frequencies approved for use in Canada as in the U.S.A.
- Maximum Access Point Module power increased to 8.4 watts
- Strong recommendation of shielded cables for all infrastructure cabling that connects
    - Access Point Modules (APs)
    - Backhaul Modules (BHs)
    - Cluster Management Modules (CMMs).
- List of Media Access Control (MAC) addresses for older modules that *do not* automatically sense the cabling scheme (These modules require the installer to correctly choose whether to use straight-thru or crossover cables.)

Issue 2 introduced the following changes:

- Updates in the Notices section for
    - European Community Notification
    - RF Exposure
    - Software License Terms and Conditions.
- Internationalization of measurement units to provide metric units aside the English units
- Updates for new hardware features, to reflect that modules that are shipped from the publication date forward
    - auto-sense the Ethernet termination (Either a straight-thru or crossover RJ-45 cable can be used to connect to either a network interface card or a hub, switch, or router.)
    - include additional cable openings to facilitate shielded cable installation.
- Description of the Canopy Bandwidth and Authentication Manager (BAM) and BAM features, which provide bandwidth and security above what an AP without the BAM provides
- Changes in specifications to
    - reflect the expanded lower temperature limit (-40°F/-40°C) for all equipment
    - provide clarifications for and add information about the CE Listing for the European Community.